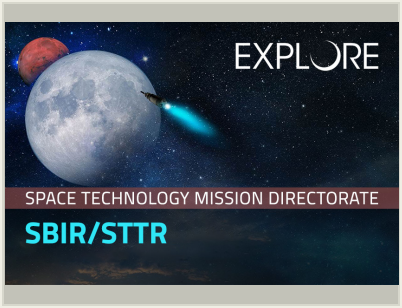
One-Meter Class Drilling for Planetary Exploration, Phase I

Completed Technology Project (2008 - 2008)

Project Introduction

The purpose of the proposed effort is to understand and characterize the fundamental limitations of drilling one to three meters into challenging materials which may be encountered in robotic drilling in situ planetary missions. The one-to-three meter range has been identified as a critical regime for planetary exploration; e.g., for potentially identifying subsurface organic material on Mars or polar resource deposits on the Moon. While there has been some technology development in planetary subsurface access, there is currently no surefire flight-like approach to robotically getting to this depth through layers of material like rock (most challenging being basalt), regolith, and icy mixtures. In Phase 1, we will experimentally identify the relative utility of rotary vs. rotary percussive drilling in the most challenging target materials under a variety of operational parameters, and extrapolate these results to three meters. Thus far there has been no apples-to-apples comparison of rotary vs. rotary-percussive drilling in this depth regime, though it is believed that rotary-percussive drilling has many advantages over rotary drilling including better penetration in hard targets. This will be a very test-heavy program. We will minimize costs by using an already available test rig - our one-of-a-kind one-meter class lunar drilling platform with rotary and rotary-percussive capability. This is an instrumented rig so we can measure system health and reactions back into the platform and we have the ability to vary drilling operational parameters to test the limits of the system. We will perform tests in Mars and lunar simulant, also readily available in our extensive library of planetary analog materials. Using the lessons learned from Phase 1 and Honeybee Robotics' 13+ years experience in subsurface access and sampling, in Phase 2 we will build a 1-3 meter drill capable of penetrating a representative 3 meter test column of layered Mars and/or lunar simulant.



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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Jet Propulsion Laboratory (JPL)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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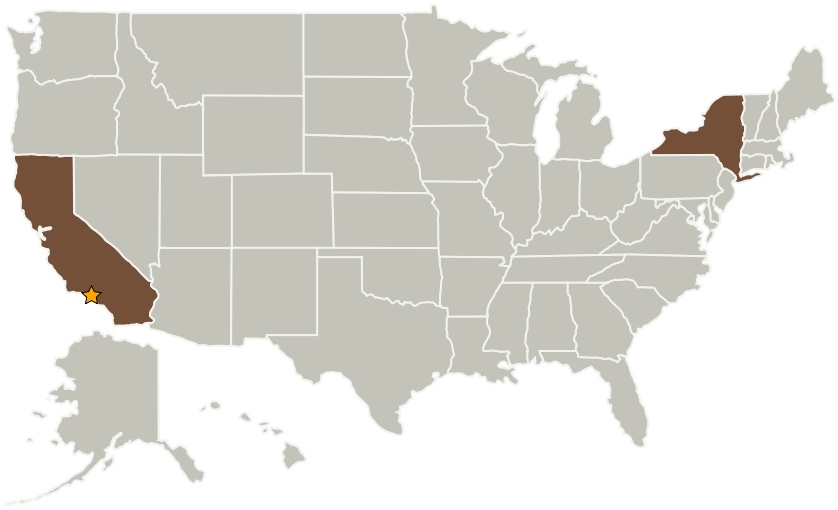
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Jet Propulsion Laboratory(JPL)	Lead Organization	NASA Center	Pasadena, California
Honeybee Robotics, Ltd.	Supporting Organization	Industry	Pasadena, California

Primary U.S. Work Locations	
California	New York

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Kiel Davis

Technology Areas

Primary:

- TX04 Robotic Systems
  - TX04.3 Manipulation
    - TX04.3.4 Sample Acquisition and Handling